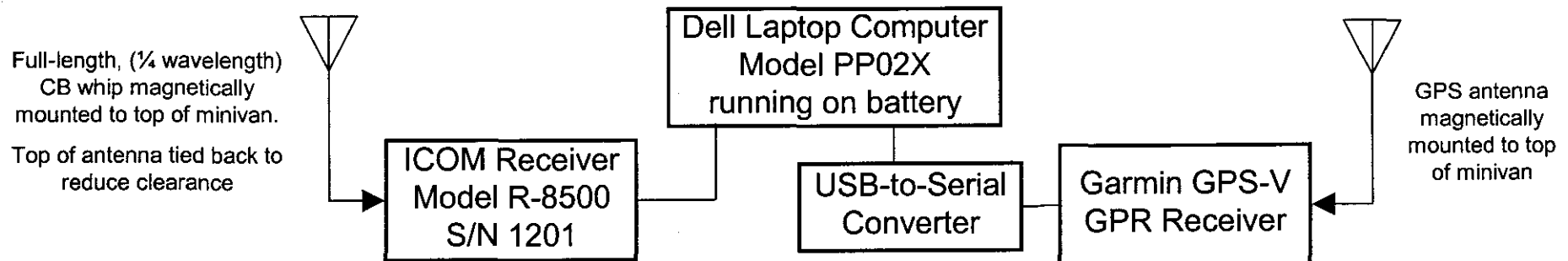


# **Interference Potential Outside of Notches**

# Test Description for Mobile Radio Measurements



- **Signal strength and position logging and mapping for driving tests**
  - Signal strength and GPS coordinates were logged at 2-second intervals to comma-delimited .CSV files.
  - When necessary to prevent excessive overlap of data points on maps, logged data was thinned by combining data points within a fixed distance of each other into a single point having a signal strength equal to maximum signal strength of the combined points.
- **Signal strength**
  - Signal strength monitored using the serial port of the receiver. Output has a lower bound of -114 dBm, even when actual signal strength is lower. [REDACTED]
  - Antenna and receiver are uncalibrated, and antenna is not tuned to specific frequencies used in tests. Intent of tests are to show relative signal strengths.
- **Receiver mode**
  - AM with 5.5 kHz bandwidth
- **Frequency selection**
  - Receiver was tuned while away from the BPL area to a frequency having no active transmissions
  - Frequency was selected within the intended injection band of an overhead injector

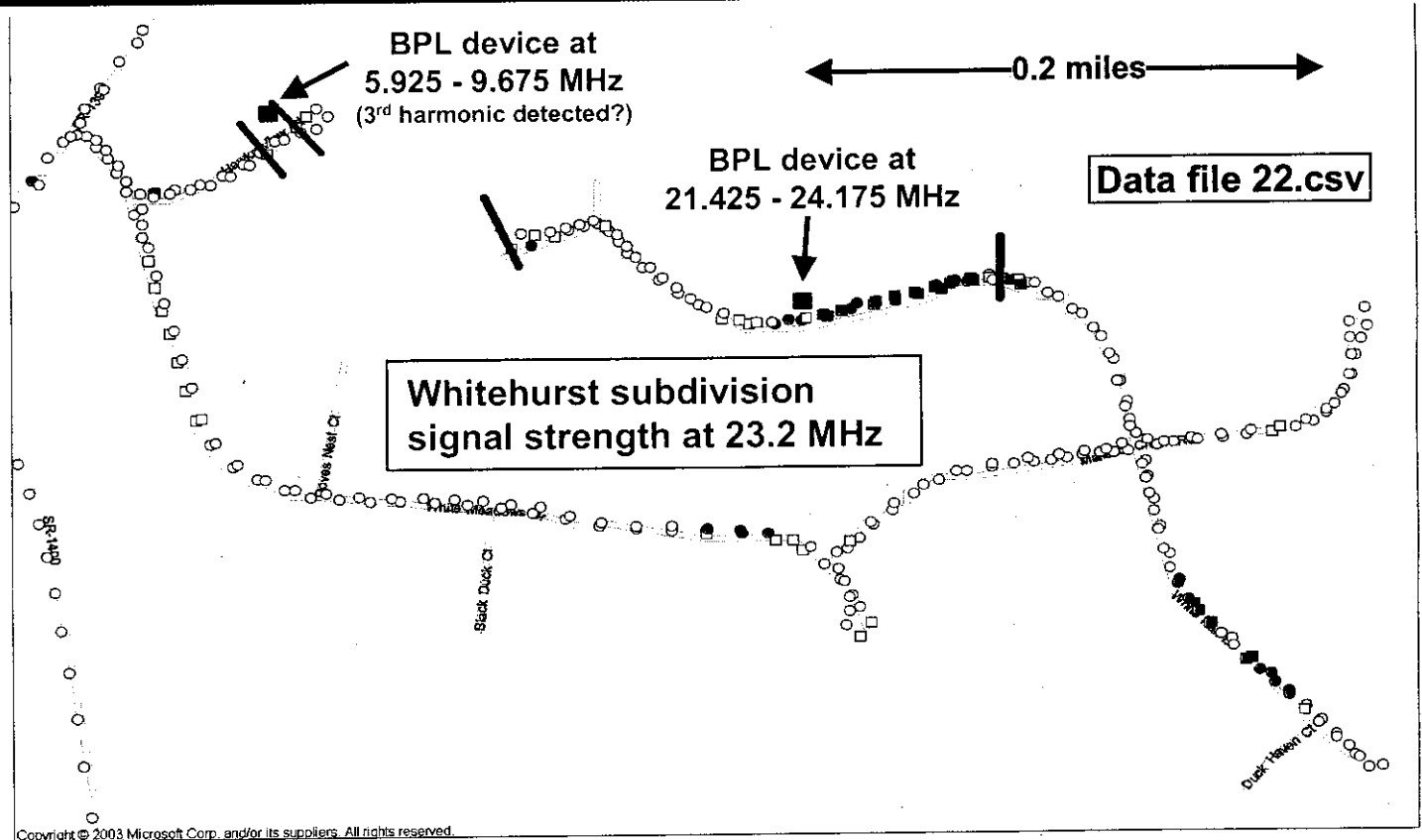
# BPL on Underground Wiring

## Geographic Extent of Emissions at One Frequency in Whitehurst

FCC Laboratory

Signal Strength  
in 5.5kHz band  
at 23.2 MHz  
(dBm)

- -85 to -76
- -90 to -86
- -95 to -91
- -100 to -96
- -105 to -101
- -110 to -106
- -113 to -111
- -127 to -114



- **Underground BPL emissions are audible for short distances; e.g., at 23.2 MHz,**
  - Fundamental emissions were audible along 320 m (0.2 mi) of road around a BPL device
  - Emissions attributed to 3<sup>rd</sup> harmonic from another device were audible along 25 m of road(Black lines mark edges of audibility)

# Un-Notched Overhead BPL

(Geographic extent of emissions  
at 23.2 MHz from overhead injector)

FCC Laboratory

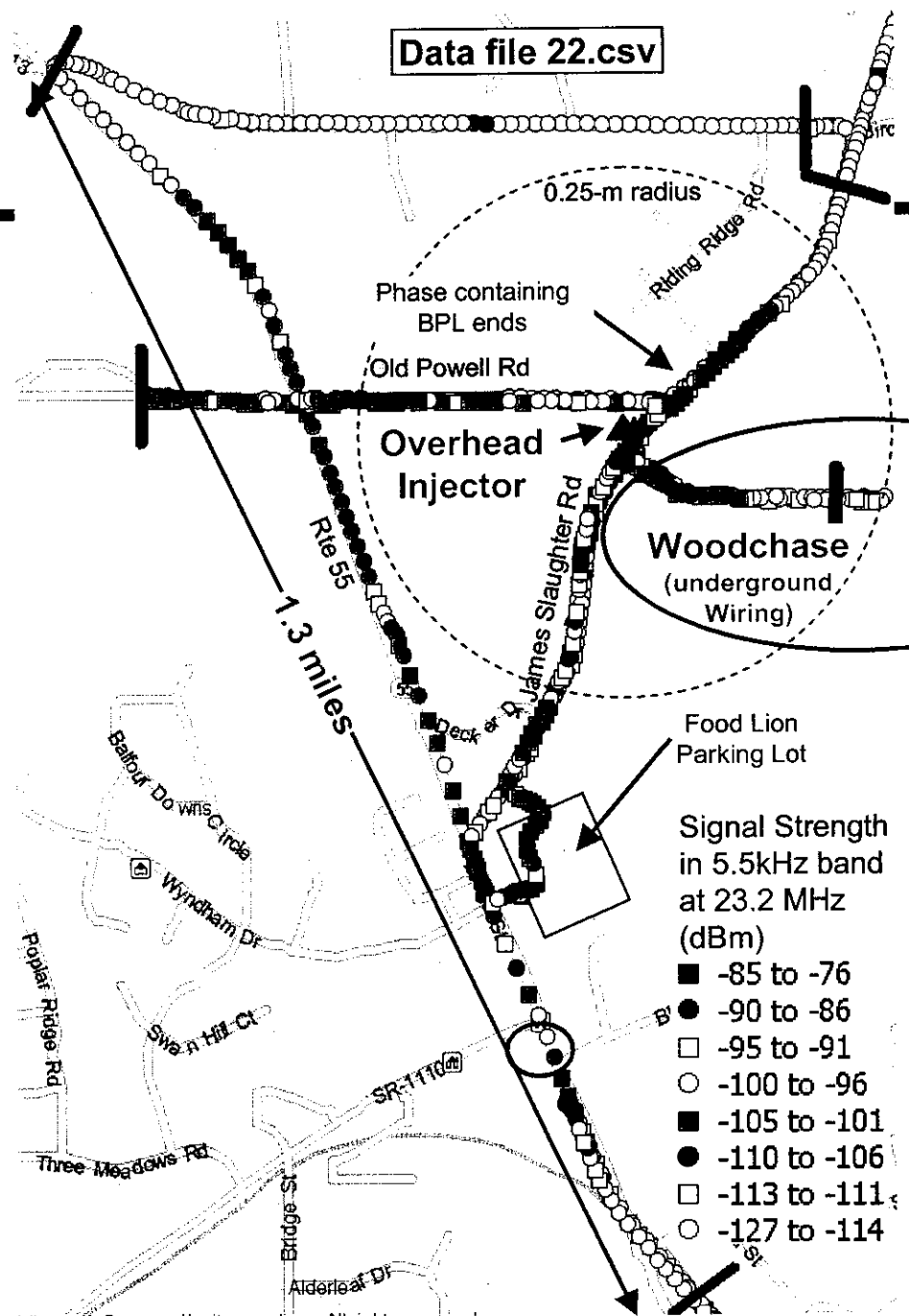
## • Effect of Single BPL Overhead Injector

– BPL audible (AM detector) between black lines

- 3.5 miles of roadway outside of the subdivision served
- 0.9 mi downline from coupler
- 0.8 mi straight line distance from coupler
- 0.19 mi (300m) from power line near coupler

– Interference distance < audible distance

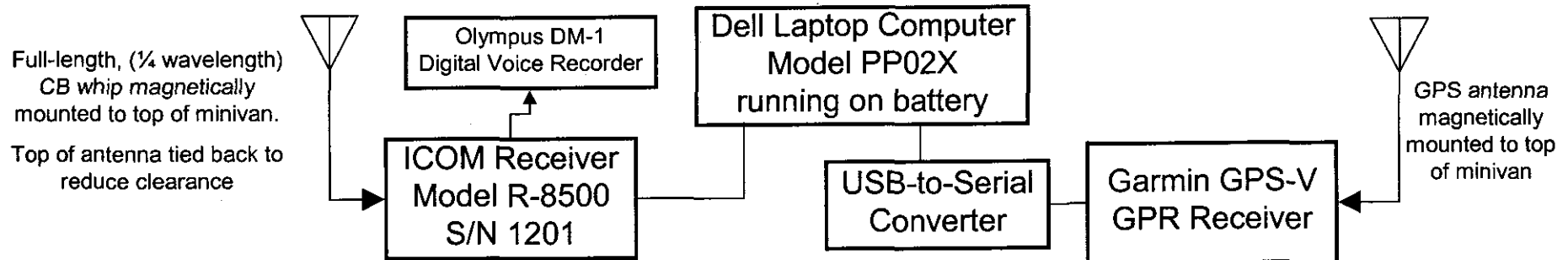
- Distance depends on strength of desired signal, type of modulation, and margin required by listener or detector



12/22/2004 - Slide 18

# Test Description for Audio/Video Collection of Mobile Radio Measurements

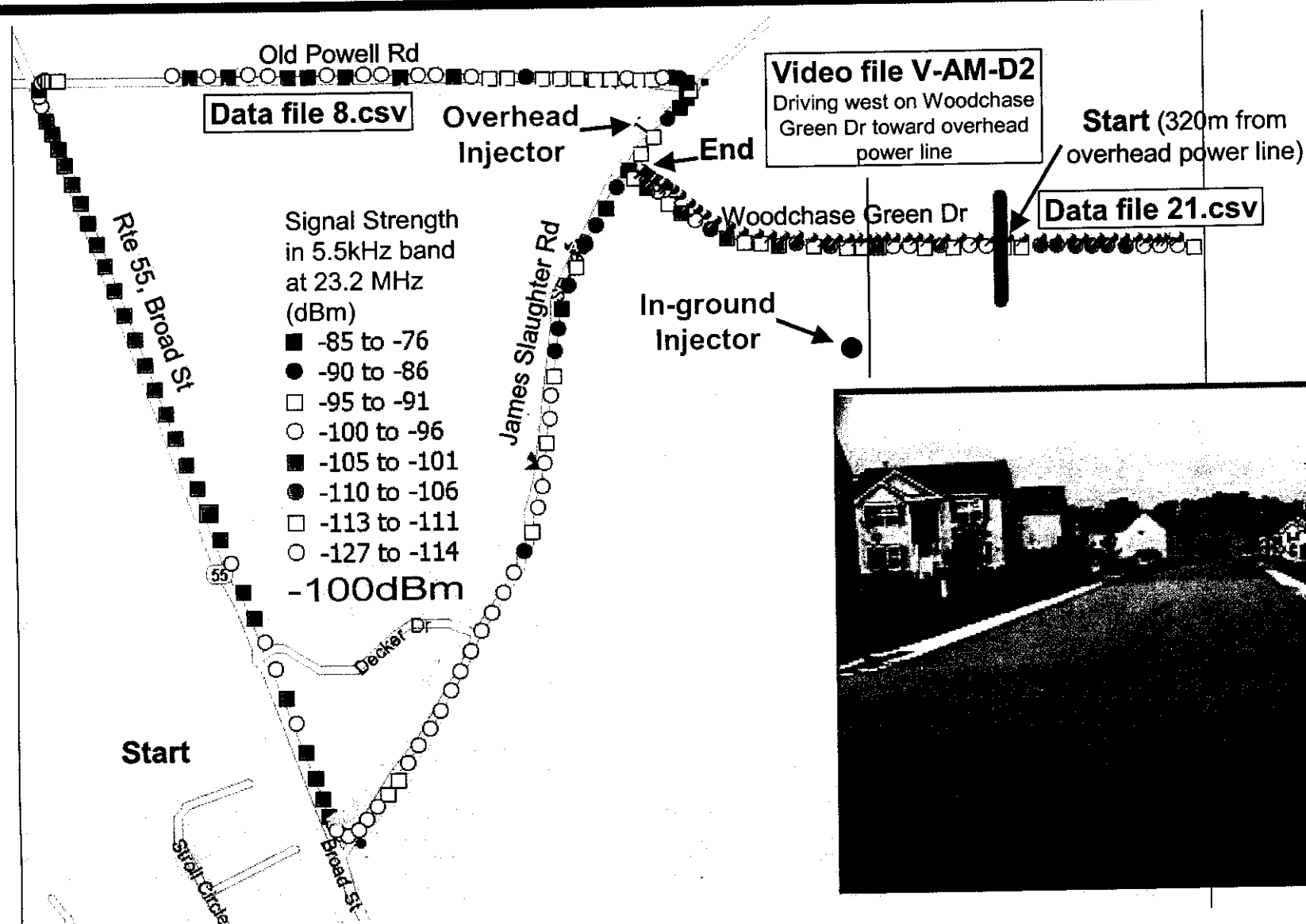
FCC Laboratory



- **Receiver mode**
  - AM with 5.5 kHz bandwidth except where SSB is specified
- **Recording**
  - Audio was recorded on a Olympus DM-1 pocket-sized digital voice recorder by direct connection to the receiver audio output
  - Video was recorded through the windshield using a Canon Model ES75A Hi8 camcorder; audio from the receiver's speaker was recorded through the built-in microphone of the camcorder
- **Frequency selection**
  - For both tests, the receiver was tuned to an un-notched frequency within the injection band of the overhead BPL injector
  - For the audio-only test, the receiver was tuned to 23.185 MHz, a frequency having no obvious transmissions (except for BPL)
  - For the video test, the radio was tuned to 21.639 MHz, where a foreign language broadcast station was received
- **Signal strength and position logging and mapping for driving tests**
  - As described previously
  - The cable between the ICOM receiver and the laptop computer was inadvertently disconnected throughout the video listening test. Signal strength data plotted on the map is from a subsequent test run while tuned off of the shortwave station to a frequency of 21.718 MHz

# Video Example

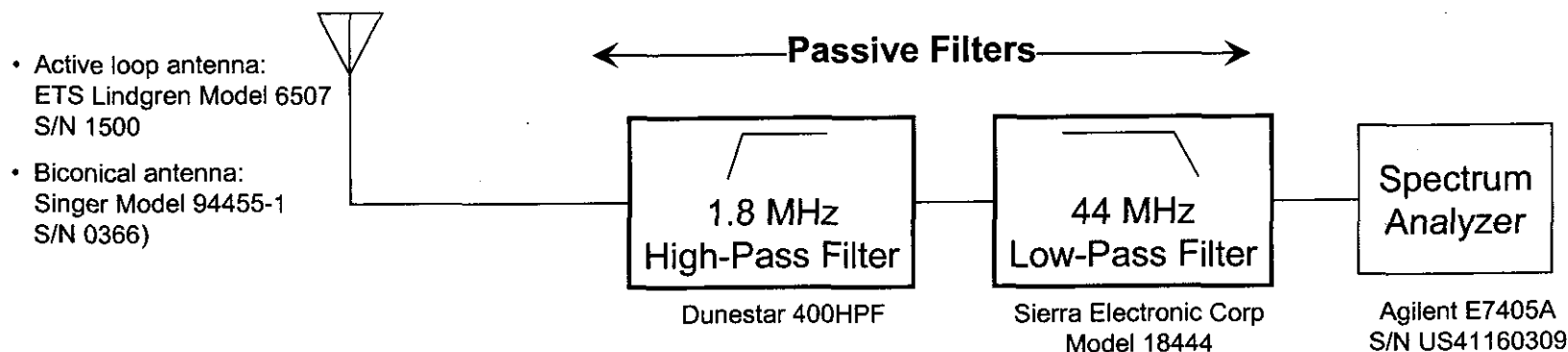
FCC Laboratory



12/22/2004 - Slide 20

# BPL Notching

# Equipment Setup for Notch-Depth Measurements



- **Calibration**

- The combination of all cables and filters was calibrated, as a function of frequency, using the tracking generator in the spectrum analyzer
- Biconical antenna data is uncalibrated below 20 MHz

- **Device under test**

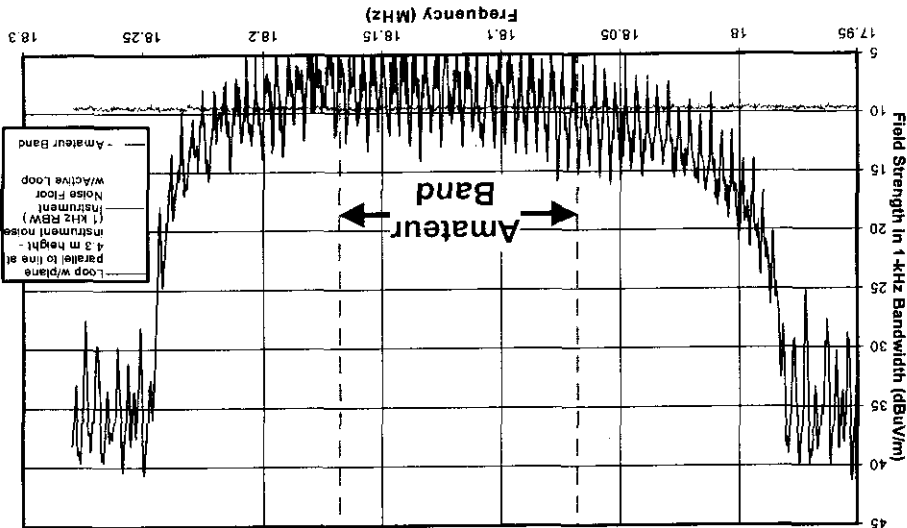
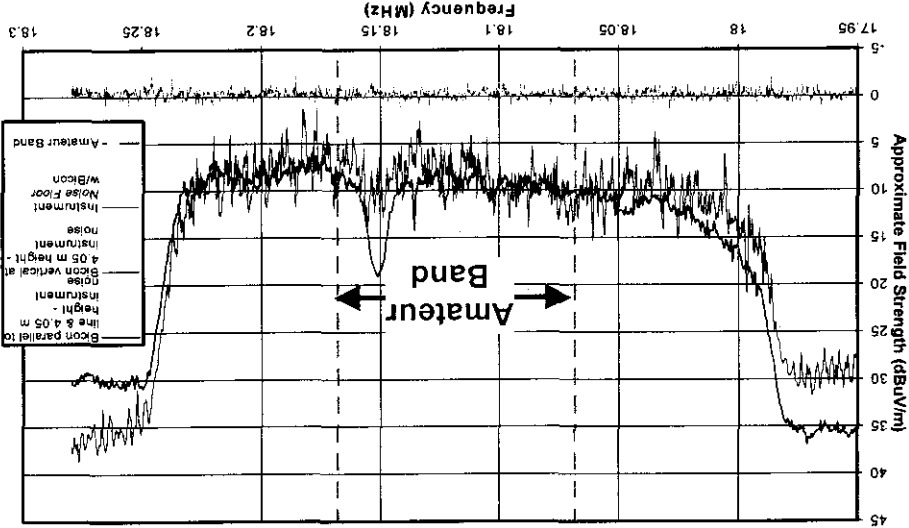
- Overhead Injector centered at 19.2 MHz at Holland Meadows

- **Measurement location**

- Antenna placed directly under power line, 7.7 meters down line (south) from BPL coupler
- Antenna height: 4.36 meters (active loop); 4.05 meters (biconical antenna)



# Notch Depth



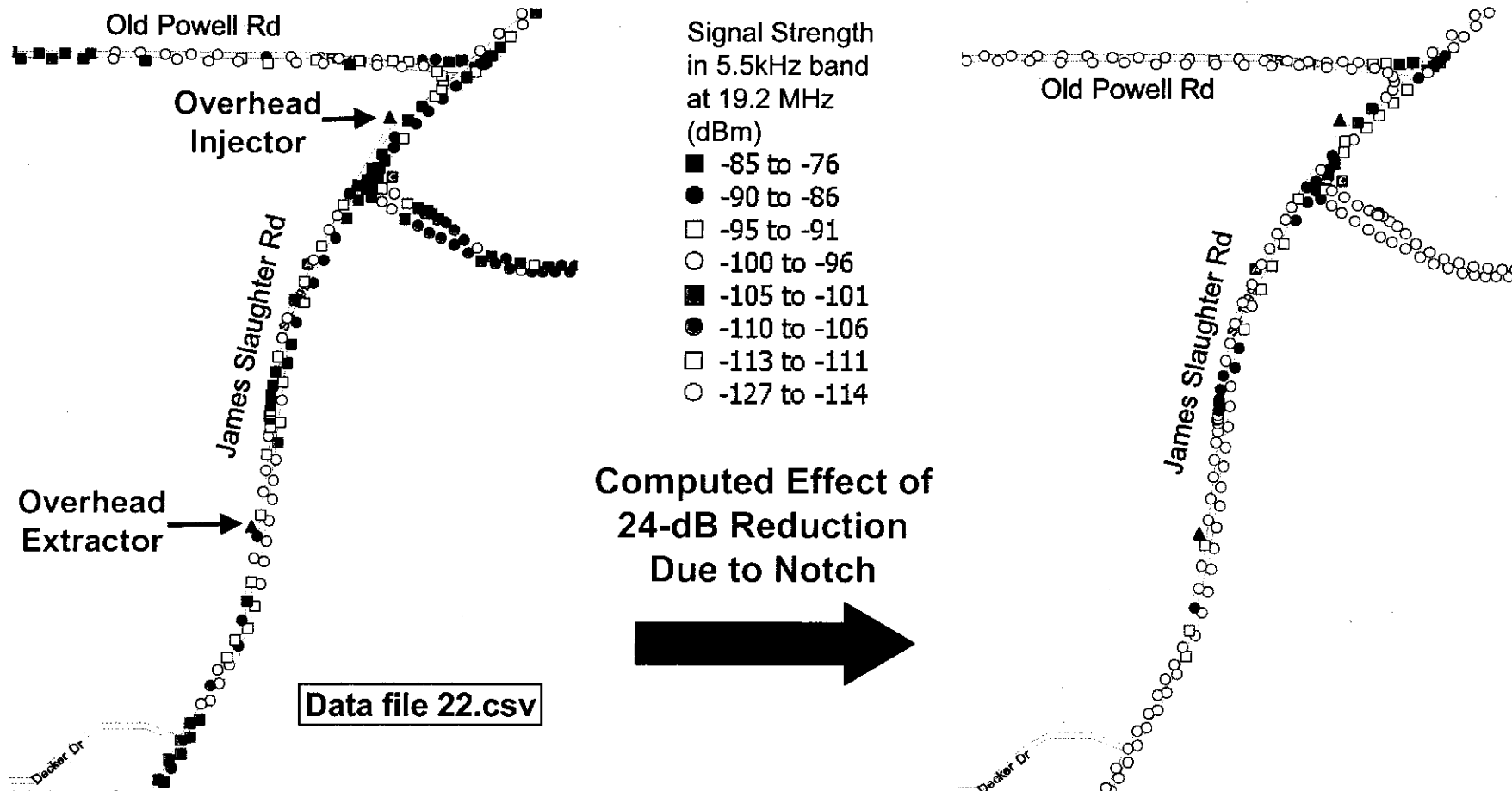
- Notch depth of only unit with complete notch (19.2 MHz injector on Holland Church Rd) was measured in two ways
  - Evaluated spectrum band averages in two moderate-resolution (9 kHz) spectra from bicon antenna
  - Evaluated OFDM peaks in high resolution (1-kHz) spectra from loop antenna
  - Results ranged from 23.4 to 25.0 dB, with an average of 24 dB

**Notch Depth is 24 dB**

# Predicted Effect of Notch

## Overhead Injector at Woodchase

FCC Laboratory

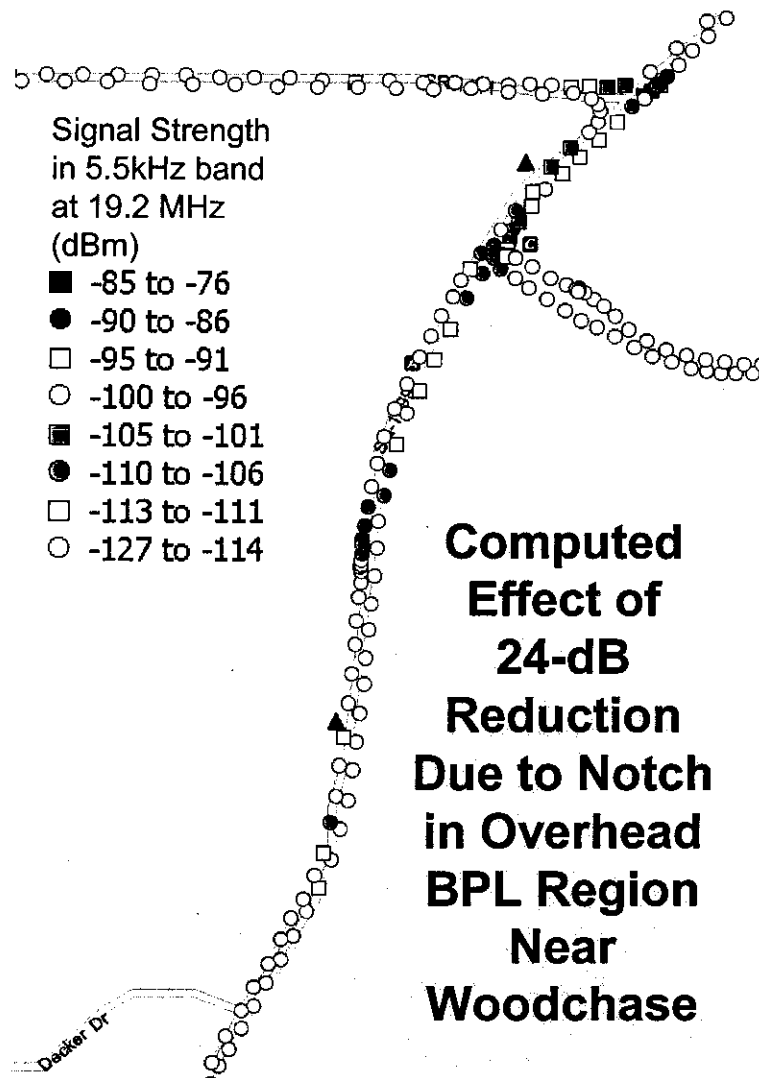


Highest emission from BPL is reduced to -100 dBm, 4-dB lower than the maximum seen in driving past the substation and 14 to 27 dB above ambient.

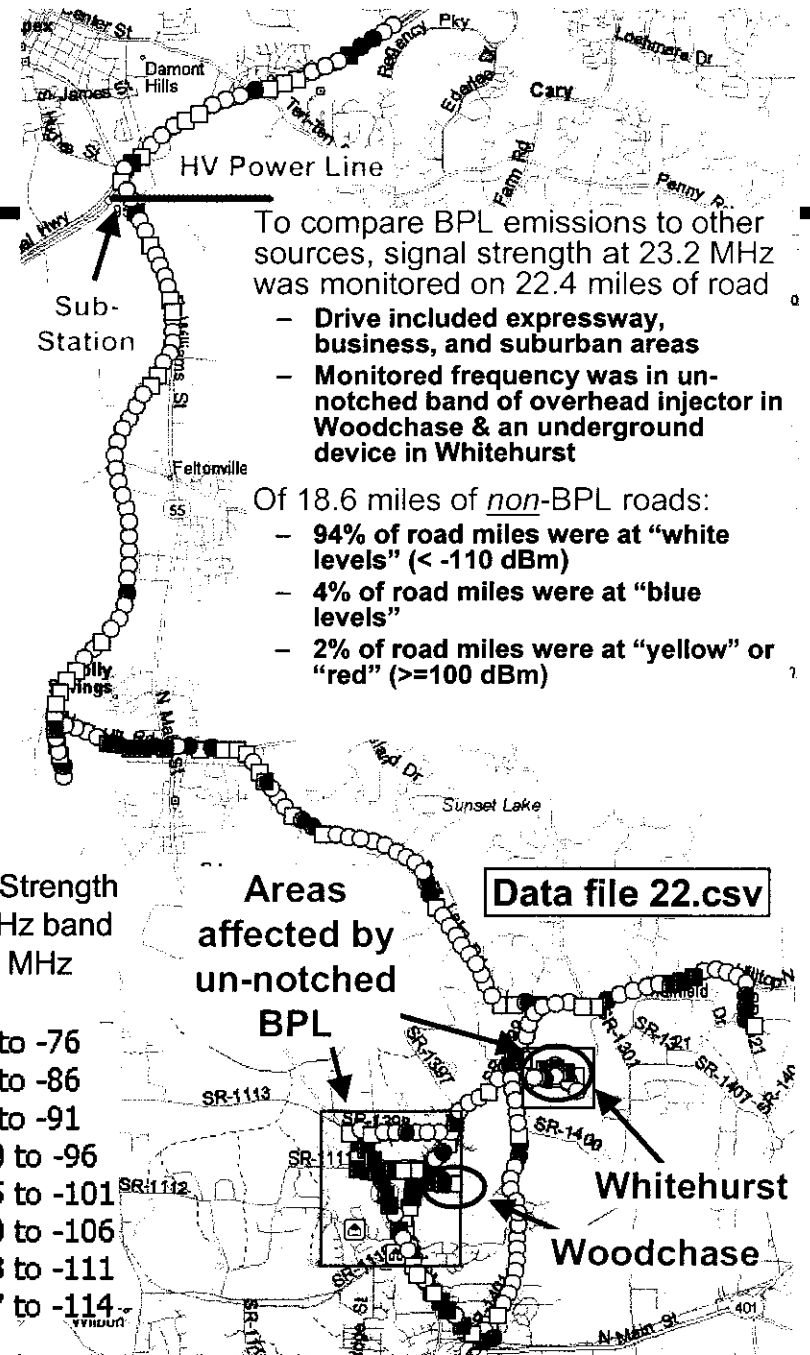
Interference distances are greatly reduced;  $\geq 110$  dBm (blue) occurs for only ~120 m of road

# Comparison of Notched BPL Signal Strength with Signal Strength in Non-BPL Regions

FCC Laboratory



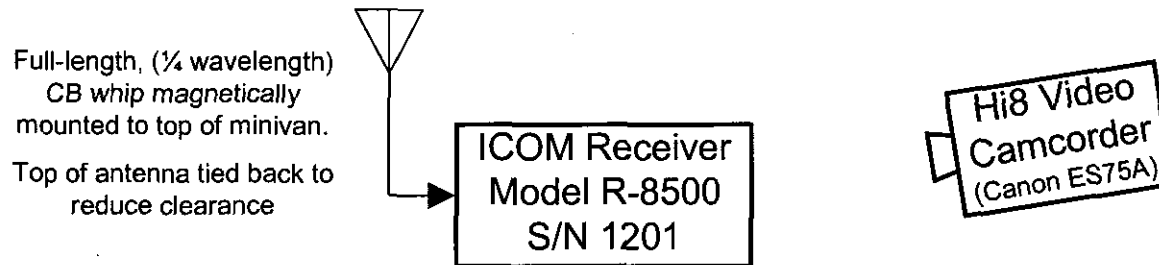
**Computed  
Effect of  
24-dB  
Reduction  
Due to Notch  
in Overhead  
BPL Region  
Near  
Woodchase**



# Radio Tests of Notch Effectiveness

FCC Laboratory

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- **Procedure**

- Receiver was manually tuned from the 15-meter amateur band through the 10-meter amateur band while recording sound and video of receiver
- Test was performed at two sites

- **Receiver mode**

- AM with 5.5 kHz bandwidth
- SSB upper sideband with 2.2 kHz bandwidth

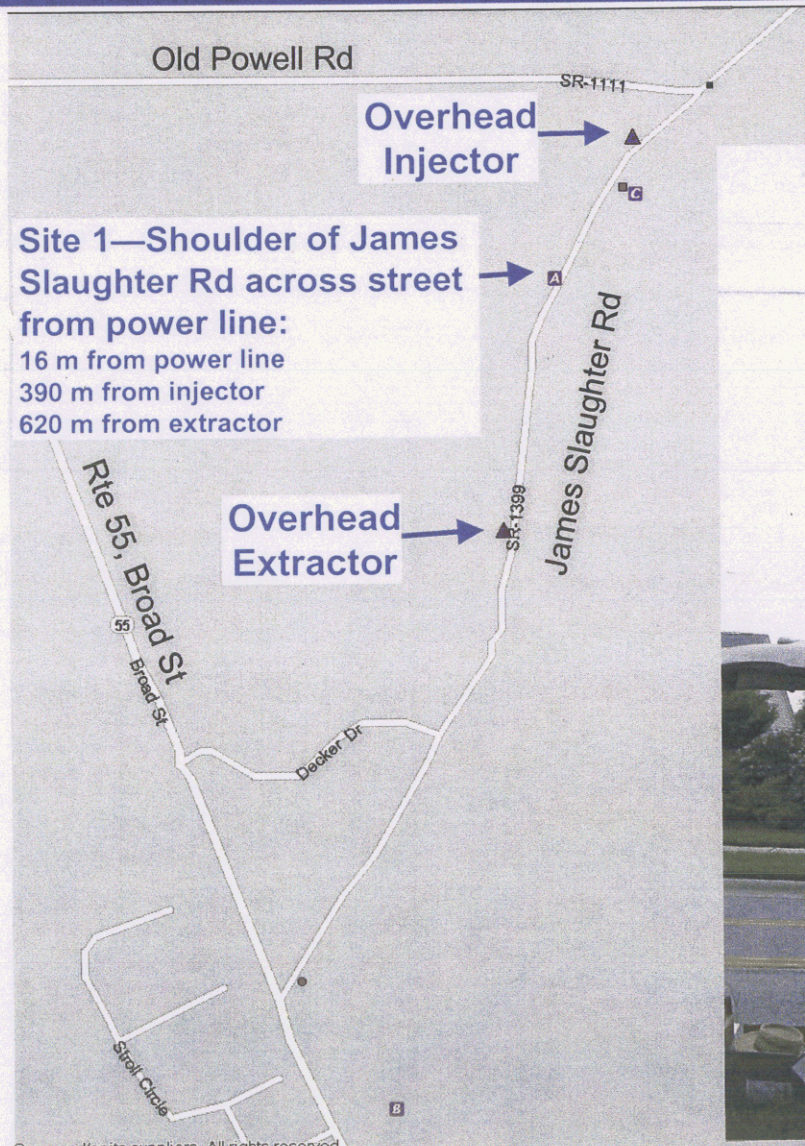




FCC Laboratory

# Radio Tests of Notch Effectiveness

## Site 1 – Shoulder of James Slaughter Rd







FCC Laboratory

# Radio Tests of Notch Effectiveness

## Site 2 – Food Lion Parking Entrance



Radio

Antenna

To BPL

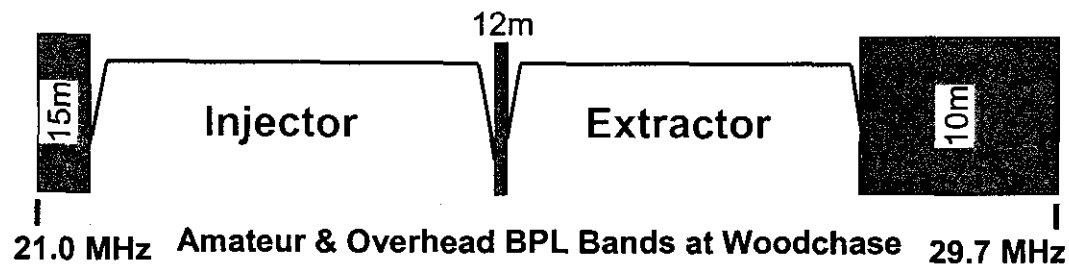




# Effectiveness of BPL Notches

## Results

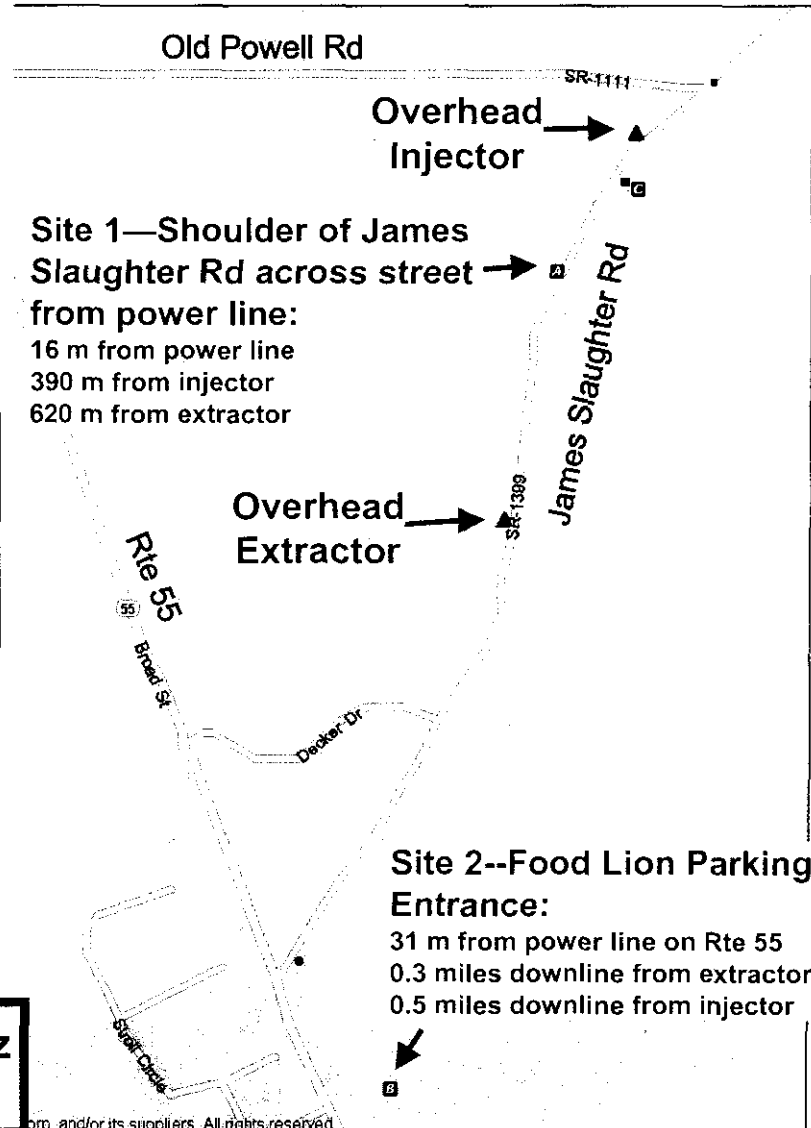
FCC Laboratory



Qualitative observations of BPL signal encroachment on amateur bands based on listening in SSB mode

| Band | SITE 1 (Video files V-AM-S1 & V-SSB-S1)       | SITE 2 (Video files V-AM-S2 & V-SSB-S2)                            |
|------|---|--|
| 15 m | Moderate in upper 15kHz;<br>Weak elsewhere    | NONE   |
| 12 m | Moderate in lower half;<br>Weak in upper half | NONE   |
| 10 m | Strong in lower 130kHz;<br>Weak elsewhere     | Moderate in lower 100kHz;<br>Weak in next 30kHz;<br>None elsewhere |

**Recommendation: Increase notch width by 100 kHz at low end of 10m band (28 MHz)**



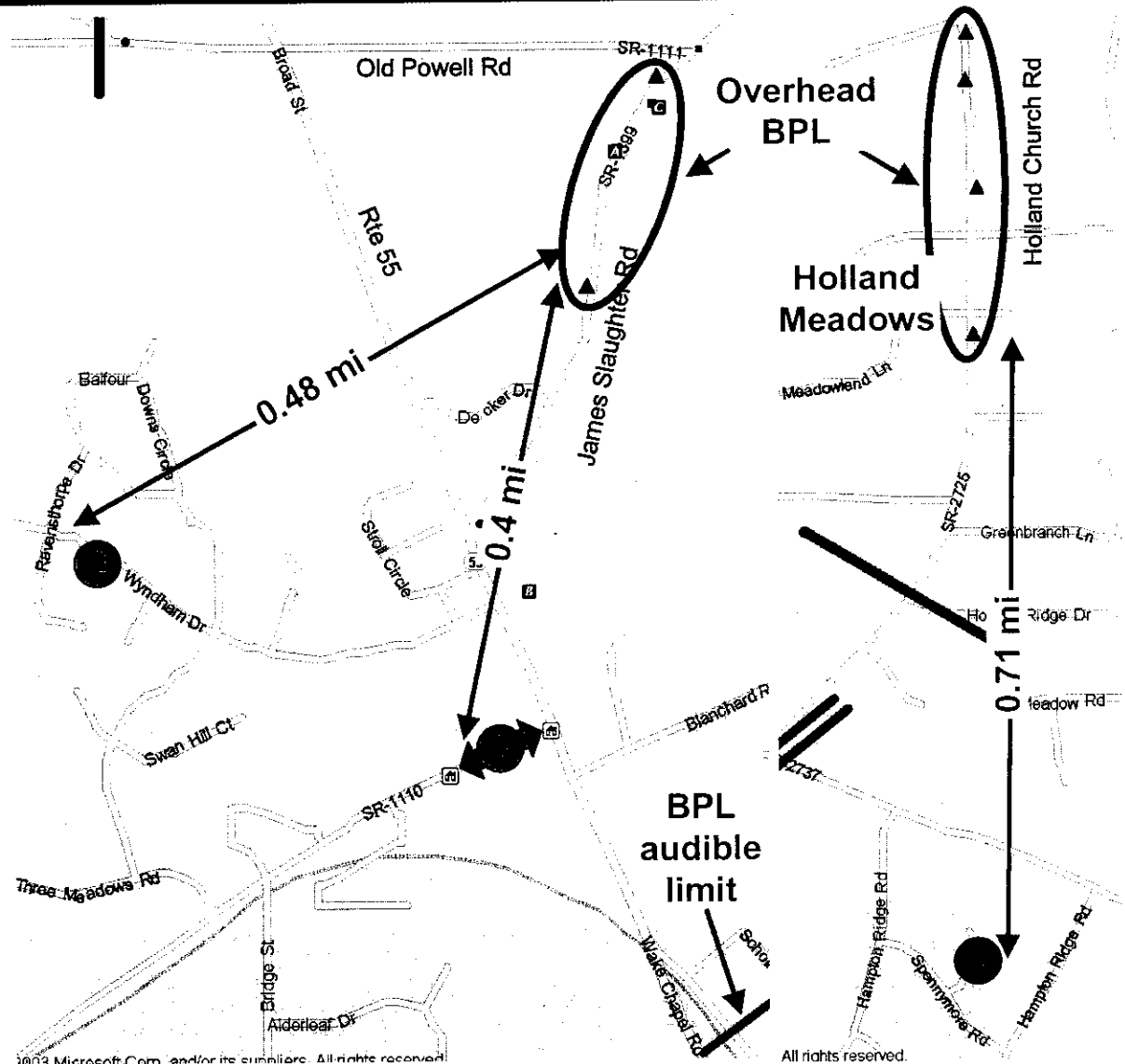
# Fixed Amateur Sites



# Fixed Amateurs

FCC Laboratory

- Fixed amateur locations included in complaint
  - ● 5813 Heathill Ct.
  - ● 509 Wyndham Dr
  - ● 201 Wilbon Rd 301B
- Interference not audible w/mobile antenna at ● & ●, even outside of notches
- ● not visited due to a mapping error. Location uncertain, but may be close enough to overhead lines on Rte 55 to detect un-notched BPL signals on mobile unit.
- No testing was performed with the fixed HF amateur antennas at any of the locations



**Ambient Westchester County, NY, Briarcliff**

3/31/04 Letter to Anh Wride et al. from E. Alan Crosswell  
Subject: Re: Harmful Interference from experimental license WD2XEQ  
Encl: Interference log for station N2YGK

4/26/04 E-mail to James Burtle from George Wheeler  
Subject: FW: Question re experimental license  
Related e-mail chain  
Attached: A letter to J. Burtle from G. Wheeler regarding the complaint of  
E. Alan Crosswell

6/11/04 Letter to Riley Hollingsworth from E. Alan Crosswell  
Re: Unresolved harmful interference from experimental license WD2XEQ  
Attached: Interference log for station N2YGK

9/10/04 E-mail to James Burtle from Bruce Franca  
Subject: FW: Briarcliff Manor Test  
Related e-mail chain

9/23, 27/04 E-mail to Bruce Franca et al. from Steve Martin  
Subject: FW: BPL in Briarcliff Manor  
Related e-mail chain

10/06/04 E-mail to Anh Wride et al. from Dave Hallidy  
Subject: Effectiveness of "Notching" BPL Signals In Amateur Radio/SWL  
Bands

10/07/04 E-mail to James Burtle from Alan Crosswell  
Subject: Re: Your BPL Complaint

10/07/04 E-mail to Bruce Franca et al. from Steve Martin  
Subject: Briarcliff Manor BPL—New Complaint  
Related e-mail chain

10/07/04 E-mail to Anh Wride et al. from [dgsvetan@rockwellcollins.com](mailto:dgsvetan@rockwellcollins.com)  
Subject: BPL Notching Effectiveness  
Related e-mail chain

10/07/04 E-mail to Ram Rao from Steve Martin  
Subject: Re: Response to you email  
Related email chain

**Bethlehem, PA      Amperion**

3/17/04      E-mail to Alan Stillwell et al. from James Burtle  
Subject: FW: Resolution of BPL Interference Complaint form Mr. Vincent

**BPL Penn Yan**

3/21/04      E-mail to rkelly@ssd.com from James Burtle  
Subject: Interference Compliant  
Related e-mail chain

4/21/04      **Penn Yan BPL Radio Interference Report**  
**Richard A. Ayers**  
**DVI Data Ventures Inc.**

4/21/04      E-mail to Alan Scrim et al. from James Burtle  
Subject: FW: BPL Complaint  
Related e-mail chain

5/06/04      E-mail to James Burtle from Dave Hallidy  
Subject: Re: Complaint of Interference Lodged 3/28/04  
Related e-mail chain

5/10/04      E-mail to Dave Hallidy from FCCHAM  
Subject: Re: Interference Compliant  
Related e-mail chain

5/24/04      E-mail to James Burtle et al. from Dave Hallidy  
Subject: Second Complaint-BPL Interference in Penn Yan, NY  
With Attachment

6/6/04      E-mail to James Burtle form Jrpmccoy@aol.com  
Subject: Claims of BPL noise in Penn Yan and resolution.  
Related e-mail chain

6/18/04      E-mail to James Burtle form Jrpmccoy@aol.com  
Subject: Follow-up to BPL complaints in Penn Yan NY  
Related e-mail chain  
Attached: David Hallidy K2D report from Penn Yann

10/06/04      E-mail to Anh Wride et al. from Dave Hallidy  
Subject: Effectiveness of "Notching" BPL Signals In Amateur Radio/SWL  
Bands

**Progress Energy, Raleigh, Faquay Varina, N.C.**

3/11/04 E-mail to [ed.wallace@pgnmail.com](mailto:ed.wallace@pgnmail.com) et al. from James Burtle  
Subject: Interference complaints  
Related e-mail chain

3/11/04 E-mail to [bill.godwin@pgnmail.com](mailto:bill.godwin@pgnmail.com) et al. from Dick Orander  
Subject: BPL Interference Complaint

3/12/04 E-mail to Alan Stillwell et al. from James Burtle  
Subject: Progress Energy BPL Complaints  
Related e-mail chain

3/13/04 E-mail letter to Len Anthony from Gary Pearce  
Subject: Progress Energy BPL

3/29/04 E-mail to Bruce Franca et al. from Anh Wride  
Subject: FW: 2<sup>nd</sup> interference complaint regarding Progress Energy Phase II BPL  
Related e-mail chain

3/31/04 E-mail to Alan Scrimie et al. from James Burtle  
Subject: FW: Complaint: BPL Interference in N.Raleigh, NC  
Related e-mail chain

4/15/04 E-mail to Alan Stillwell et al. from James Burtle  
Subject: FW: Progress Energy Interference Complaints-who should these be directed to?

4/26/04 E-mail to Len Anthony et al. from Frank A. Lynch  
Subject: Re: Progress Energy Carolinas BPL Trial  
Related e-mail chain

4/28/04 E-mail to [flynch@nc.rr.com](mailto:flynch@nc.rr.com) from Ahn Wride  
Subject: Response to your email on BPL  
Related e-mail chain

5/5/04 E-mail to Alan Stillwell et al. from James Burtle  
Subject: FW: Interference Complaint Regarding your BPL System  
Related e-mail chain

5/11/04 E-mail to James Burtle et al. from Tom Brown  
Subject: RESEND-May 11, 2004- RE: Formal complaint-Progress Energy Part 15 devices

5/12/04 E-mail to Len Anthony from Gary Peace  
Subject: 3<sup>rd</sup> Interference Complaint regarding Progress Energy Phase II  
BPL Interference

5/14/04 E-mail to James Burtle et al. from Tom Brown  
Subject: RESEND – May 14, 2004 – Formal complaint – Progress Energy  
Part 15 devices  
Attachments: Previous complaints made to Progress Energy, the FCC, and  
a copy of Mr. Len Anthony's email

5/19/04 E-mail to n4tab@earthlink.net from Riley Hollingsworth  
Subject: Mr. Brown—my comments on your April 27 complaint & May  
11 follow-up  
Related email chain

5/21/04 E-mail to James Burtle et al. from Gary Pearce  
Subject: 4<sup>th</sup> Interference Complaint regarding Progress Energy Phase II  
BPL Interference

6/10/04 E-mail to James Burtle et al. from Tom Brown  
Subject: Re: 8<sup>th</sup> RESEND – June2, 2004 – Progress Energy Part 15  
devices  
Related e-mail chains

9/29/04 E-mail to James Burtle et al. from Tom Brown  
Subject: Reply and additional complaint – Progress Energy BPL systems –  
Wake County, NC  
Attached: Reply and additional complaints

10/5/04 E-mail to Sheryl Wilkerson et al. from Gary Pearce  
Subject: "Notching" BPL signals on Amateur Radio/SWL Bands  
Related e-mail chain

### **Cape Girardeau**

8/14/03 **Product Safety Engineering, INC. Test Report**  
**Main.net Power Line Communications Inc.**

9/8/04 Letter to David Solomon et al. from Christopher Imlay  
Subject: Experimental Station WC2XXX

**Manassas, VA**

- 3/24/04      **Report of Harmful Interference From a Broadband Over Power Line  
Trial or Deployment**  
**Donald W. Blasdel**
- 4/15/04      Letter to James Burtle from Allen P. Todd  
Subject: Radio Interference caused by BPL deployment in Manassas

**Alliant Cedar Rapids, IA**

- 4/5/04      E-mail to Alan Stillwell et al. from Jim Spencer  
Subject: Fw: Noise Status-March 2004  
Related e-mail chain
- 4/22/04      E-mail to Tim VanWeelden from Jim Spencer  
Subject: Harmful Interference from BPL
- 5/10/04      Letter to Tim VanWeelden from Richard L. Sellers  
Subject: BPL Test Installation in Cedar Rapids  
Related Letters and e-mail chains
- 5/17/04      E-mail to Alan Stillwell fro Rick Sellers  
Subject: BPL Interference in Cedar Rapids, Iowa  
Attached: Letter to Tim VanWeelden
- 5/17/04      E-mail to James Burtle et al. from Jim Spencer  
Subject: Response Requested
- 5/27/04      Letter to Tim VanWeelden from Robert Hirvela  
Subject: BPL Complaint
- 5/27/04      E-mail to Anh Wride et al. from Arlo W Meyer  
Subject: Fw: BPL
- 6/1/04      E-mail to timvanweelden@alliantenergy.com from James Burtle  
Subject: PBL Interference complaints  
Related e-mail chain
- 6/4/04      E-mail to Anh Wride et al. from Steve Martin  
Subject: Re: ATTENTION: ACTION REQUESTED  
Related e-mail chain
- 6/15/04      Letter to Jim Burtle from Daniel Hinz  
Attached: Report

**6/18/04 Cedar Rapids, Iowa, BPL Trial System Radio Frequency Interference Tests Report  
Cedar Rapids BPL Steering Committee  
Dale G. Svetanoff**

10/7/04 E-mail to Anh Wride et al. from [dgsvetan@rockwellcollins.com](mailto:dgsvetan@rockwellcollins.com)  
Subject: BPL Notching Effectiveness

10/14/04 E-mail to James Burtle from Jim Spencer  
Subject: Re: BPL Notching—Actual Experience  
Related e-mail chain

**Cottonwood, AZ**

5/19/04 Report of Harmful Interference from a Broadband Over Power Line Trial or Deployment  
Tom Schrum  
Comment on 04-37

6/16/04 E-mail to Anh Wride et al. from Ernie & Betsy Cummings  
Subject: Interference from Broadband Over Power Line Transmission  
Attached: BPL Trial complaint from Floyd E. Cummings (Ernie)  
Related e-mail chain

6/17/04 Letter to James Burtle from Clinton Pierce  
Subject: Complaint against interference Amateur Hams Bands from Broadband Power Line System  
Attached: BPL Trial complaint from Clinton L. Pierce and Data sheets  
Related e-mail chain

6/17/04 Letter to James Burtle from Robert B. Thompson  
Subject: Interference in Cottonwood  
Attached: Data sheets

6/18/04 E-mail to James Burtle from Ernie & Betsy Cummings  
Subject: Interference from Broadband Over Power Line Transmission  
Attached: BPL Trial complaint from Floyd E. Cummings (Ernie)  
Related e-mail chain

6/21/04 Report of Harmful Interference from a Broadband Over Power Line Trial or Deployment  
Gregory A. Allen  
Attached: Data sheets

7/12/04 Report of Harmful Interference from a Broadband Over Power Line Trial or Deployment  
David Kiggins CBT

7/31/04 Letter to Arizona Public Service (Customer Service) from Mike Kinney  
Subject: Interference issues of the two BPL tests sites located in Cottonwood, AZ, to Amateur Radio communication  
Attached: Cottonwood, AZ BPL Trial System Radio Frequency Interference Report

8/5/04 E-mail to James Burtle from Steven Pearson  
Subject: FW: bpl complaint  
Attached: Letters and Data sheets  
Related e-mail chain

8/14/05 E-mail to Anh Wride et al. from Rod Rosenbarger  
Subject: Interference  
Attached: BPL Trial complaint from Rodney W. Rosenbarger and a report on Advanced Refractive Effects Prediction System

8/25/04 E-mail to James Burtle from Richard Fusinski  
Subject: BPL Interference

9/2/04 E-mail to James Burtle et al from Anh Wride  
Subject: FW: BPL Interference complaint, new  
Related e-mail chain

9/21/04 E-mail to [shpigler@electricbroadband.com](mailto:shpigler@electricbroadband.com) from James Burtle  
Subject: FW: BPL Interference Reports  
Attached: Letters, Data sheets, and a Report of Harmful Interference from BPL dated 8-9-04

10/6/04 E-mail to Sheryl Wilkerson from Robert Shipton  
Subject: Verde valley Amateur Radio Association, Cottonwood, AZ BPL Notching summary  
Attached: Committee Report and BPL Signal Strength Readings

10/7/04 E-mail to James Burtle from [jimc100@juno.com](mailto:jimc100@juno.com)  
Subject: Re: Your BPL Complaint  
Related e-mail chain

10/7/04 E-mail to Anh Wride et al from [kit@ka0wuc.org](mailto:kit@ka0wuc.org)  
Subject: BPL comments  
Attached: PDF file containing a series of measurements from a BPL system in service near Cottonwood Arizona.



10/11/04

Letter to James Burtie et al. from Christopher Inlay  
Subject: Experimental Station WB9XVP at Cottonwood  
Attached: Document with data

E. Alan Crosswell  
Amateur Radio Station N2YBK  
144 Washburn Road  
Briarcliff Manor, NY 10510  
212-854-3754  
n2ybk@weca.org

March 31, 2004

Anh Wride  
Federal Communications Commission  
Office of Engineering and Technology  
Room 7-A825 Portals II  
445 12th Street SW  
Washington, DC 20024  
Awride@fcc.gov

Alan R. Stillwell  
Federal Communications Commission  
Room 7-C210  
445 12th Street SW  
Washington, DC 20024  
Astillwe@fcc.gov

Riley Hollingsworth  
Federal Communications Commission  
1270 Fairfield Road  
Gettysburg, PA 17325  
Rholling@fcc.gov

James R. Burtie  
Federal Communications Commission  
Chief, Experimental Licensing Branch  
Room 7-A267  
445 12th Street SW  
Washington, DC 20024  
jburtie@fcc.gov

Re: Harmful interference from experimental license WD2XEQ (File No. 0050-EX-ML-2003)

Dear FCC staff:

I believe with some certainty that recent interference to FCC licensed radio operation that I have experienced is caused by the Ambient Corporation field trial using Con Edison's medium voltage electrical transmission facilities operating under FCC Special Temporary Authorization with callsign WD2XEQ (File No. 0050-EX-ML-2003) in and around Briarcliff Manor, NY where I reside. The experimental power line communications system appears to be interfering with the operation of my licensed station in the 14 MHz band. Per the terms of Special Condition (1) of the Commission's Special Temporary Authorization, I ask that you have Con Edison immediately cease operation of this system until such time as the interference is resolved as they are interfering with a primary licensee of the frequency band in question.

I will be glad to work with you to demonstrate that the recurring interference I have detected is in fact caused by Con Ed's system. A simple "on-off" test of their PLC system should demonstrate whether it is the root cause as the